

Diabetes Mellitus - Diabetic Ketoacidosis (DKA) - Full Clinical Guideline

Reference No: CG-T/2023/052

Does my patient have confirmed DKA?

ALL three of the following **must** be present to confirm DKA:

1. Capillary blood glucose (CBG) > 11.0mmol/l or known diabetes
2. Capillary blood ketones > 3.0 mmol/l OR 2+ ketonuria (on urinary ketone sticks)
3. Venous pH < 7.3 and/or venous bicarbonate < 15mmol/l

What are the immediate actions required?

- ABC assessment including all routine observations including GCS
- Capillary blood glucose check and ketone check
- Obtain urgent IV access and commence fluids (As per box A, action 2)
- Venous bloods obtained for U&E, bicarbonate, FBC and venous blood gas and blood cultures
- Urinalysis for ketones (if capillary ketones not available), MSU, β HCG (*if applicable*)
- VTE prophylaxis - unless contraindicated

What are the areas of prescribing/management that need consideration?

Assess the patient and using this DKA full guideline or the DKA summary guideline, formulate a plan for the following:

1. Prescribe IV fluids as appropriate
2. Assess K⁺ level and add K⁺ to fluids if appropriate
3. Commence Fixed rate insulin infusion (FRII) at 0.1units/kg/hr
4. Ensure that the medical team and nursing staff know what monitoring is required
5. Be clear about what resolution of DKA looks like (the exit strategy)

When should a patient's care be escalated?

Severe DKA is a life-threatening emergency (pH < 7.1 or ketones > 6 or HCO₃ < 5/anion gap >16)






If ketone/glucose levels do not fall as expected, **call for senior advice**. A HDU bed may be sought if:





- Hypokalaemia (K⁺ < 3.5mmol/l)
- GCS < 12
- Shocked pulse > 100 or SBP < 90
- Young (18-25yr)
- Pregnant (ketones kill babies, NOT glucose)

What do we ultimately want to achieve?

- Resolution of ketonaemia <0.6mmol/l **and**
- Venous bicarbonate >15mmol/l **and**
- Diabetes controlled with SC insulin **and**
- Patient eating and drinking **and**
- Patient has been seen by the Diabetes Team, or there is a plan in place to do so
- OR exit from pathway has been recommended by the diabetes team

| Box A: Immediate management 0 to 60 minutes | |
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| Action 1 | <p>URGENT INITIAL ASSESSMENT AS ABOVE</p> <p>Assess for precipitating factors: Non-compliance, sepsis/infection, stress, idiopathic, others (steroids, alcohol, pregnancy, pump failure)</p> <p>Stop all nephrotoxic drugs and ketoacidosis causing medications (eg SGLT2 inhibitors, dapagliflozin [®], canagliflozin [®], empagliflozin)</p> <p style="text-align: center;">CONTINUE BASAL INSULIN (See Box A Action 3 for insulin brand names)</p> <p>If patient is using pump therapy - stop the pump and completely disconnect. Refer to diabetes specialist nurses for input.</p> |
| Action 2 | <p>IV FLUIDS</p> <p>Ensure 0.9% Sodium Chloride is administered via infusion pump</p> <p>Is the patient shocked?</p> <p>If systolic BP<90mmHg:</p> <ul style="list-style-type: none"> • Give 1 litre of 0.9% sodium chloride over 15 minutes (Bag 1) • If systolic BP remains<90mmHg repeat and inform Medical colleague for advice <p>If Systolic BP>90mmHg</p> <ul style="list-style-type: none"> • Give 1 litre of 0.9% sodium chloride over 1 hour (Bag 1) <p>Subsequent bags are prescribed as follows:</p> <ul style="list-style-type: none"> • The rate of fluid replacement dependent on age/fitness/dehydration of the patient and the potassium content of the bag: Plan fluid replacement and use clinical judgement. <p>PLEASE REFER TO ACTION 4 BELOW TO DETERMINE IF POTASSIUM SHOULD BE ADDED TO THE BAG OF FLUIDS</p> <p>Bag 2 - 0.9% sodium chloride 1L +/- 20mmol/l KCl over 2hrs OR 0.9% sodium chloride 1L +/- 40mmol/l KCl over 4hrs</p> <p>Bag 3 - 0.9% sodium chloride 1L +/- 20mmol/l KCl over 2hrs OR 0.9% sodium chloride 1L +/- 40mmol/l KCl over 4hrs</p> <p>Bag 4 - 0.9% sodium chloride 1L +/- potassium chloride over 4 hours</p> <p>Add 10% glucose given at 125ml/hr if the blood glucose falls below 14mmol/l. This fluid</p> |

| | <p>runs alongside the 0.9% NaCl infusion.</p> <p>Note: Hypotension is likely to be low circulating volume but consider other causes such as sepsis/heart failure</p> | | | | | | | | |
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| Action 3 | <p>Insulin:</p> <p>RDH: Prescribe 30 units soluble insulin in 30ml NaCl - prefilled syringes (ready-made). These must be obtained from Pharmacy.</p> <p>QHB: Prescribe 50 units soluble insulin (Actrapid) in 49.5mls NaCl. This is manufactured by nursing staff on the ward</p> <p>Commence on a FIXED RATE insulin infusion at 0.1/units/Kg/hr</p> <p>MAXIMUM rate 15ml/hr</p> <p>If patient takes long acting insulin eg Insuman Basal®, Humulin I®, Glargine®, Levemir®, Degludec®, Toujeo® Semglee®, Abasaglar® continue alongside fixed rate insulin infusion (FRII)</p> <p>Disconnect all continuous subcutaneous insulin infusion pumps and do not use without specialist advice</p> | | | | | | | | |
| Action 4 | <p>Potassium (KCl):</p> <p>Life-threatening hypokalaemia can occur with insulin infusion</p> <table border="0"> <thead> <tr> <th>Venous potassium level</th> <th>Potassium Chloride(KCL) replacement</th> </tr> </thead> <tbody> <tr> <td>>5.3mmol/L</td> <td>NONE</td> </tr> <tr> <td>3.5-5.3mmol/L</td> <td>10mmol/hr (Eg. 20mmol over 2 hrs)</td> </tr> <tr> <td><3.5</td> <td>Senior advice required</td> </tr> </tbody> </table> <p>If KCl rate of infusion >10mmol/hr cardiac monitoring is recommended. Senior input should be sought if cardiac monitoring is unavailable</p> | Venous potassium level | Potassium Chloride(KCL) replacement | >5.3mmol/L | NONE | 3.5-5.3mmol/L | 10mmol/hr (Eg. 20mmol over 2 hrs) | <3.5 | Senior advice required |
| Venous potassium level | Potassium Chloride(KCL) replacement | | | | | | | | |
| >5.3mmol/L | NONE | | | | | | | | |
| 3.5-5.3mmol/L | 10mmol/hr (Eg. 20mmol over 2 hrs) | | | | | | | | |
| <3.5 | Senior advice required | | | | | | | | |
| Action 5 | <p>Reassess patient:</p> <p>Poor urine output for > 2 hours  Bladder scan/Catheterise</p> <p>Persistent vomiting AND reduced GCS  Consider NGT</p> <p>SpO₂ <94% on air  ABG/CXR</p> <p>Persistent acidosis  Consider other causes</p> <p>GCS <13  Consider CT Head</p> <p>Seek senior review if patient not responding to treatment or is deteriorating</p> | | | | | | | | |

| Box B: Management 60 minutes to 6 hours | |
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| Aims | <ul style="list-style-type: none"> • Venous bicarbonate rise of at least 3mmol/L/hr OR a rate of fall of ketones at least 0.5mmol/L/hr and blood glucose fall of at least 3mmol/L/hr • Maintain serum potassium within normal range • Avoid hypoglycaemia |
| Action 1. | <p>Monitoring requirements</p> <p>CBG  Hourly</p> <p>VBG  2, 4, 6, 12, 18 hours</p> <p>Fluid balance  Hourly</p> <p>NEWS  Hourly</p> |
| Action 2. | <p>IV FLUIDS</p> <p>Follow fluid prescription as per <u>Box A Action 2</u></p> <p>Refer to <u>Box A Action 4</u> to determine if potassium is required</p> <p>When CBG <14mmol/L add 125mls/hr of 10% glucose (to run alongside NaCl)</p> <p>You can consider reducing the rate of NaCl to reduce the risk of fluid overload</p> |
| Action 3. | <p>REASSESS PATIENT</p> <p>Assess volume status hourly, HR, BP, urine output, JVP, chest auscultation and adjust fluid rates accordingly</p> |
| Action 4. | <p>ENSURE TREATMENT TARGETS ARE BEING MET</p> <ol style="list-style-type: none"> 1. Fall of CBG of >3mmol/L until CBG <14mmol/l 2. Fall of capillary blood ketones of >0.5mmol/l/hr <p>Rise in venous bicarbonate of >1.0mmol</p> <p>If patient is not improving as expected, check the patency of cannula and IV lines, check the rate of the insulin infusion and check the infusion pumps BEFORE increasing insulin by 1-2 units (ml)/hr</p> |

| Box C: Management 6 to 12 hours | |
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| Action 1. | <p>IV fluids</p> <p>Bag 5 - 1L 0.9% NaCl +/- KCl over 4 hours (after completion of previous 4 hour bag)</p> <p>Bag 6 - 1L 0.9% NaCl +/- KCl over 6 hours</p> <p>If CBG <14mmol/l add 10% glucose at a rate of 125ml/hr (using separate IV access)</p> |
| Action 2. | <p>REASSESS PATIENT</p> <p>Consider DKA resolution</p> <p>Reassess CV status</p> <p>Check CBG, blood ketones, VBG, chloride, U&E, and signs of DKA resolution</p> |
| Action 3. | <p>Refer early to Diabetes Team</p> <p>Diabetes specialist nurse referral</p> |

| Box D: Management 12 to 24 hours | |
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| Actions | <p>RESOLUTION OF DKA</p> <p>Resolution is defined as pH >7.3 AND/OR blood ketones of <0.6mmol/L Bicarbonate of 15mmol</p> |
| | <p>If DKA has resolved and the patient is eating and drinking switch to SC insulin and continue insulin infusion for at least 1 hour after administration of subcutaneous insulin with a meal</p> <p>If DKA has resolved but the patient cannot eat or has another indication for IV insulin (severe sepsis/MI) use variable rate insulin infusion</p> <p>Inform the Diabetes Specialist Nurse and the Diabetes Team</p> |
| By 24 hours | <p>If the Ketonaemia and acidosis have not resolved</p> <ul style="list-style-type: none"> • Seek urgent senior review or diabetes team support <p>Consider starting Levemir® in newly diagnosed diabetes at a dose of 0.25 units per Kg once daily subcutaneously</p> |

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| Development of Guideline: | Diabetes safety group |
| Consultation with: | Diabetes consultants Diabetes specialist nurses |
| Approved by: | Diabetes Safety Group - October 2020 Medical Division - 17/12/2020 Reviewed no change – Diabetes Safety Group – Dec 2023 Medicine Division - Dec 2023 |
| Review Date: | December 2024 – Extended to April 2025 |
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